



Nuclear Quality Assurance Certification of the MCNP- ORIGEN Activation Automation tool

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Changing the World's Energy Future

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INTRODUCTION

Objectives:

- Introduce the MCNP-ORIGEN Activation Automation (MOAA) tool.
- Showcase Nuclear Quality Assurance (NQA-1) Certification process.

Motivation:

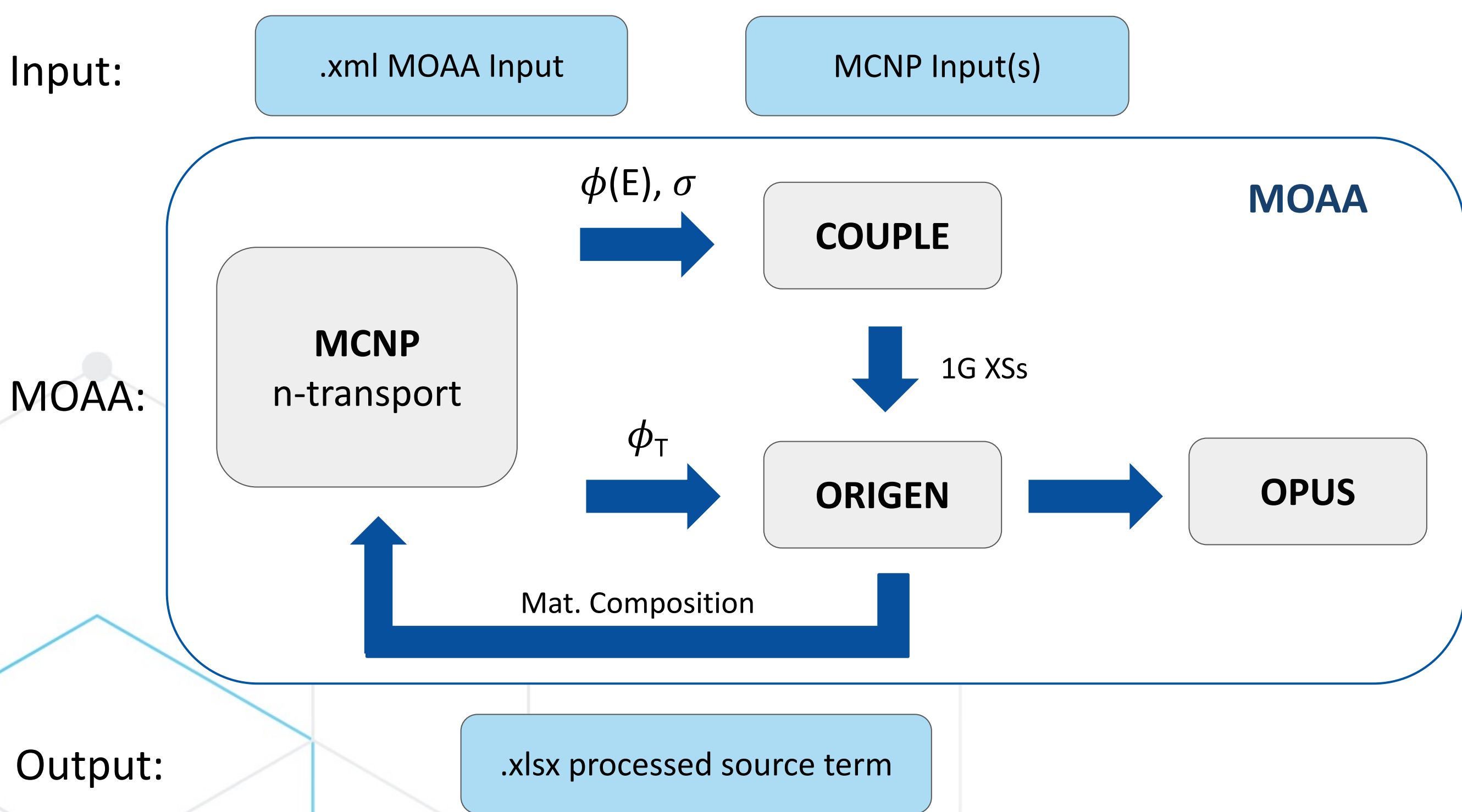
- The irradiation Experiment Neutronics Analysis group (C-150) supports the Advanced Test Reactor (ATR) and the Transient Reactor Test Facility (TREAT).
- Analyses provide source terms for inventory and shipping purposes, demonstration of compliance with safety limits, comparison to PIE, etc.
- MOAA streamlines this process by writing MCNP tally cards, reading MCNP tallies, creating ORIGEN input files, executing SCALE, and standardizing the results post-processing.

Background:

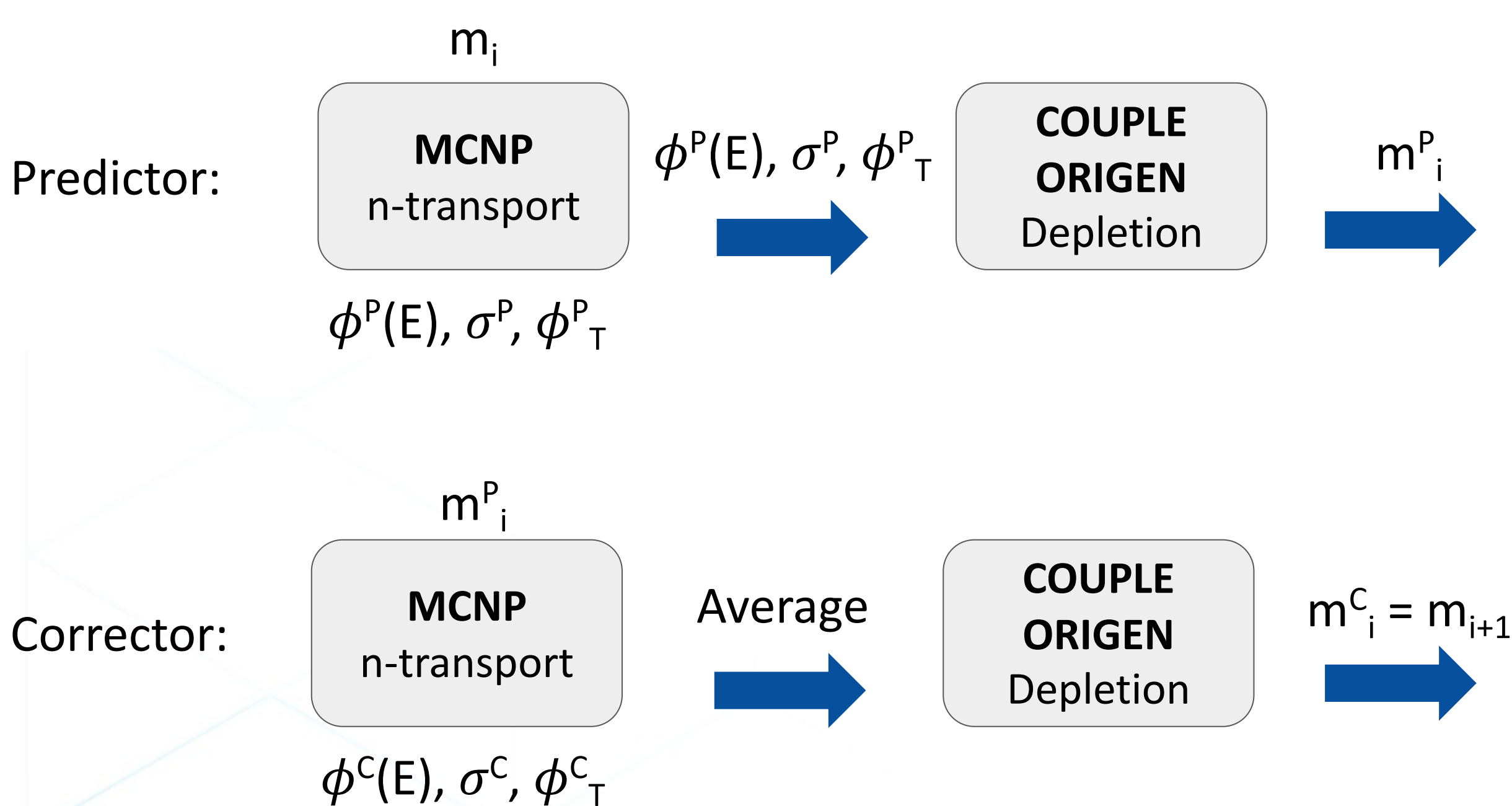
- Similar tools couple transport solvers to depletion tools.
 - Transport solver: obtains geometry dependent parameters.
 - Depletion tool: calculates isotopic composition after irradiation/decay.
- MOAA has a lobe power scaling capability, which is unique to the ATR.
 - Other tools targeting ATR and TREAT are no longer maintained.
- MOAA couples MCNP and ORIGEN-S, while other tools still rely on ORIGEN2 (deprecated).
 - ORIGEN-S uses the CRAM which is the most accurate depletion algorithm.

IMPLEMENTATION

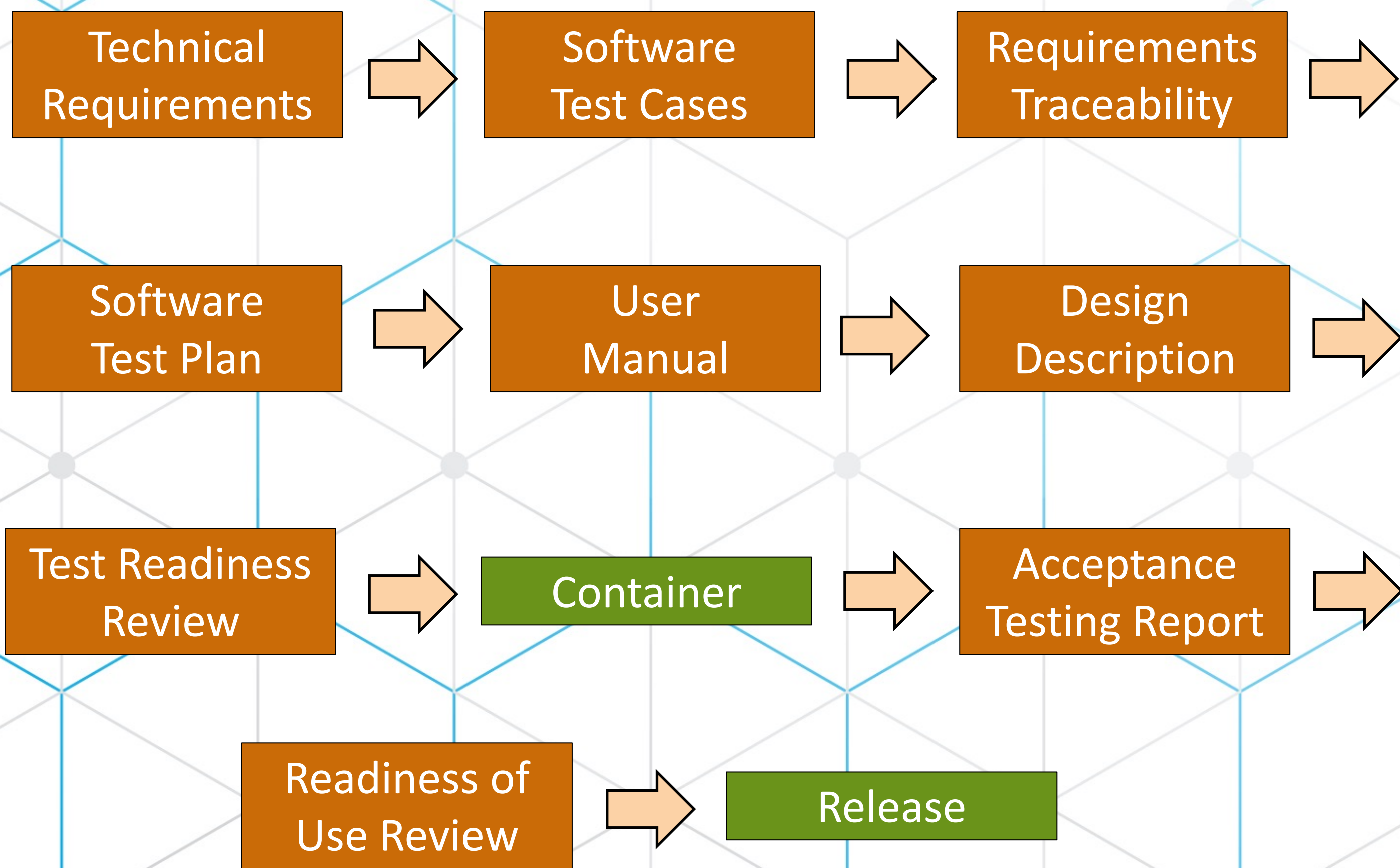
Workflow:



Predictor/Corrector Scheme:



NUCLEAR QUALITY ASSURANCE



- Quality assurance program for systems that prevent or mitigate postulated accidents.
- Current efforts for MOAA to fulfil the ASME NQA-1 Standard.
- Requirements target different steps in the software development process: *Design requirements, Design, Implementation, and Verification.*
- Design requirements: *Functional (20), Usability (54), and System Interface (42).*
- Testing: comparison of the expected and observed behavior. Acceptance/System Testing of the design requirements.

Ex: The system shall accept the user input file sub-node "atr". The default value of this sub-node shall be "false". Acceptable values of this sub-node shall be case-independent "true" or "false".

Two tests necessary:

- 1- This test parses an UIF without the sub-node <atr>. The test passes if the settings in the controller take the value 'False' for the attribute atr.
- 2- This test parses an UIF with the sub-node <atr>true<atr>. The test passes if the settings in the controller take the value 'true' for the attribute atr.



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